



Identification of vulnerable locations with high lead exposures in Michigan

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Ex. 5 Deliberative Process (DP)

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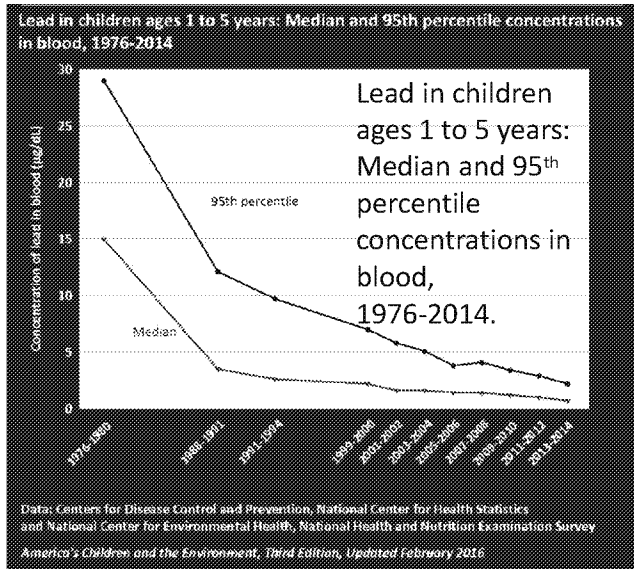
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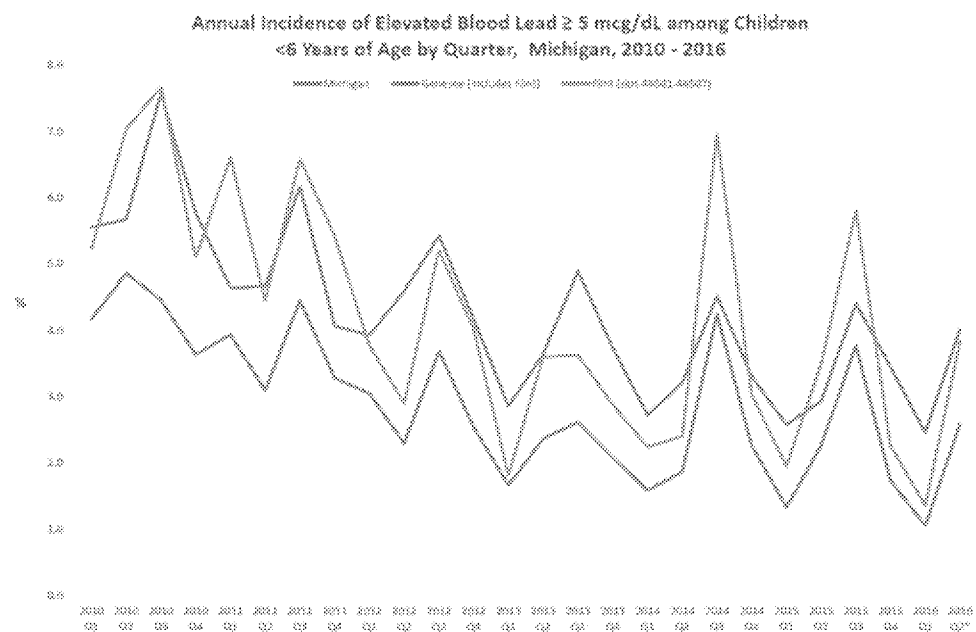
Objectives

- Identify high Pb risk locations in MI, based on blood lead levels (BLL), for further study and mitigation
 - compare results to previous public maps*
- Identify key factors for high BLL
- Provide an approach generalizable to other States and geographic locations, to help inform Pb targeting efforts

The Need

- Pb is a toxic legacy contaminant which remains a public health priority.
- Multimedia issue requiring approaches for identifying high Pb risk areas





*Data for Quarter 2 of 2016 are incomplete and subject to change. Data for Quarter 3 of 2016 will be presented when the quarter is complete.
 People who have had multiple tests are counted only once per year for annual counts. People counted in 2015 who were tested again after 1/1/2016 are counted in both years.
 Counts on this report include both capillary and venous blood tests.

* Data for Quarters 2 and 3 of 2016 are incomplete and subject to change.

Source: Michigan Department of Health and Human

Service: http://www.michigan.gov/documents/flintwater/Flint_Blood_Testing_Report_29Jul2016_531130_7.pdf

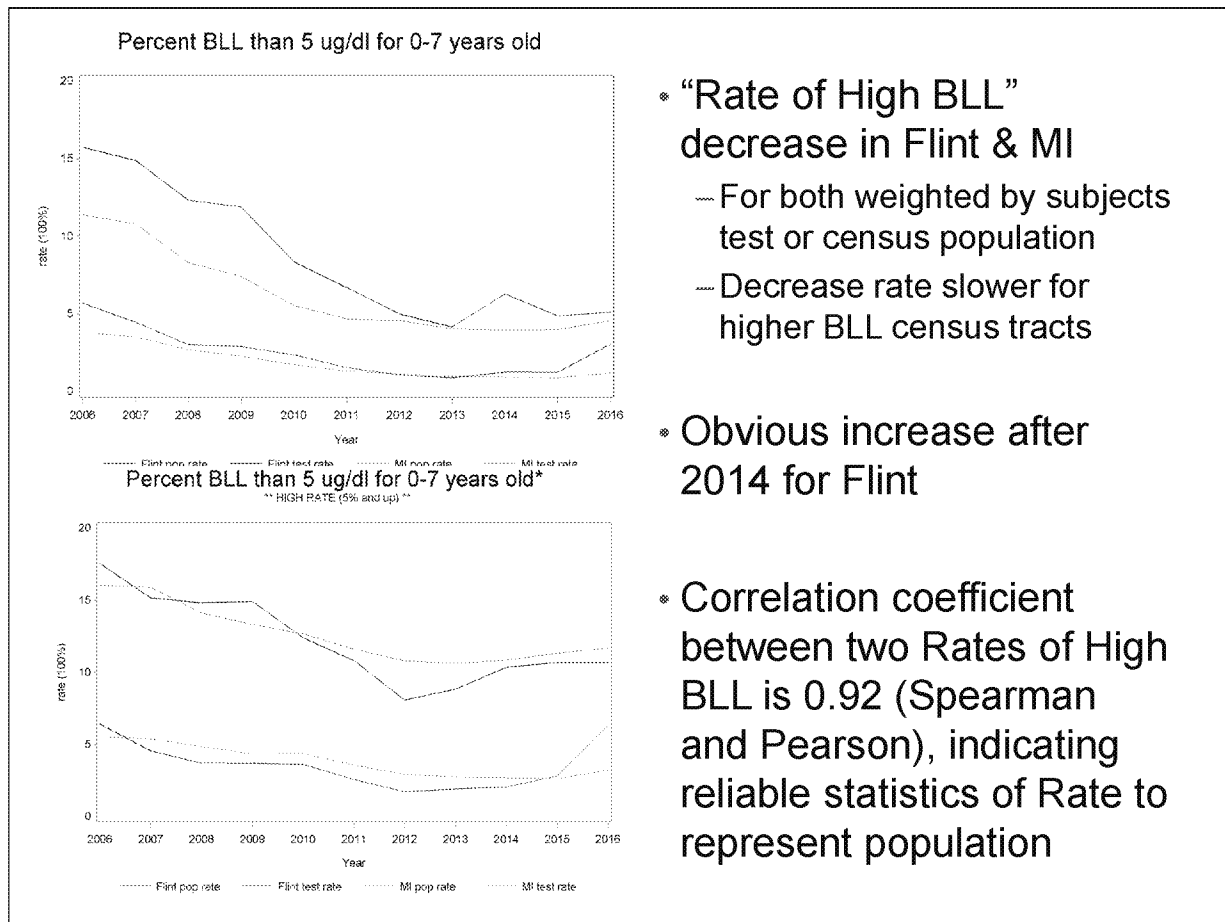
MI Children - BLL sampling

- Children enrolled in Medicaid are required; children not enrolled - different rate
- All children in Flint, MI were tested after Flint drinking water crisis
- In 2015, ~20% of children < 6 years were tested; 37.9% for 1-2 years old 37.9%

From Computer0 I:\00 project\lead\StateBlood\subject sampling
sample selection readme.doc
MI doc.pdf

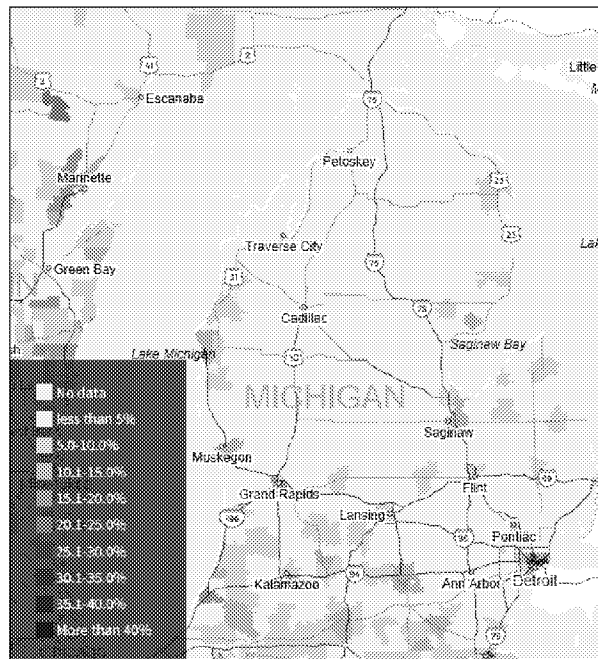
Method

- Obtained and QA'd BLL data received from MI DHHS
- Geocoded BLL data (converted addresses to lat./lon.)
- Calculate “Rate of High BLL” – 2 approaches
 - (1) # children with BLL>5 ug/dL divided by # children tested
 - (2) # children with BLL>5 ug/dL divided by # children in census tract
- Spatial analysis to identify high risk areas
 - Anselin Local Morans I
 - Getis-Ord Gi*
- Apply GLM for main contributing factors



SAS program for correlation coefficient is located in Ncomputer2: C:\0BLL\MI\user\4_ct_rate.sas

Reuters Nationwide Childhood BLL Analysis Map by Zip Code and/or Census Tract

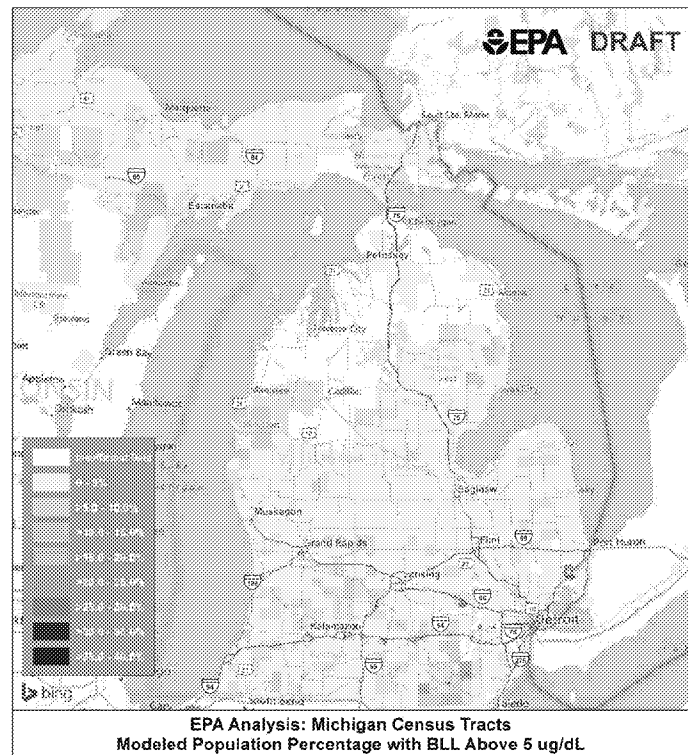


<https://www.reuters.com/investigates/special-report/usa-lead-testing/#interactive-lead>

- 1) Hot-spot with high BLL identified by Reuters for MI
- 2) Detroit, Flint and others
- 3) Zip codes (480)
- 4) 2005-2015 from States or CDC

Computer0: I:\00 project\lead\StateBlood\0000000output. The file was from Tony. He generate from Reuter_map together with transport GIS I sent to him (see email map comparison of MI Original Data file from slide .msg in Computer0: I:\00 project\lead\StateBlood\0000000output). The transport GIS was generated from Ncomputer2 c:\0bll\ct_rate.mxd. Just for 2014-2016 three years

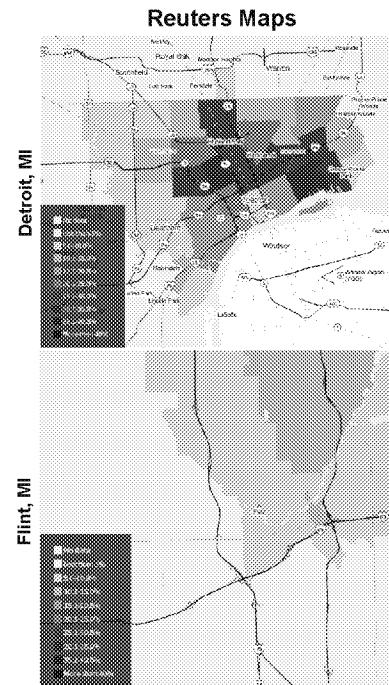
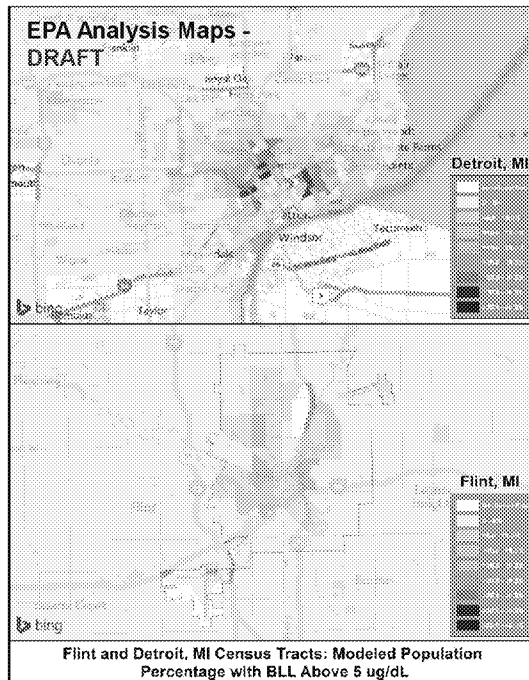
EPA/ORD Analysis: MI Census Tracts – Modeled Population Percentage with “Rate of High BLL”



- 1) Hot-spot with high BLL identified by US
- 2) Detroit, Flint and others
- 3) Census tracts and by years (2014-2016) (2813 census tracts)

Computer0: I:\00 project\lead\StateBlood\0000000output. The file was from Tony. He generate from Reuter_map together with transport GIS I sent to him (see email map comparison of MI Original Data file from slide .msg in Computer0: I:\00 project\lead\StateBlood\0000000output). The transport GIS was generated from Ncomputer2 c:\0bll\ct_rate.mxd. Just for 2014-2016 three years

Reuters and EPA/ORD Analyses for Flint and State of MI: Modeled Population Percentage with “Rate of High BLL”



Hot spots for Detroit area and Flints
Better resolution for our method

Computer0: I:\00 project\lead\StateBlood\0000000output. The file was from Tony. He generate from Reuter_map together with transport GIS I sent to him (see email map comparison of MI Original Data file from slide .msg in Computer0: I:\00 project\lead\StateBlood\0000000output). The transport GIS was generated from Ncomputer2 c:\0bll\ct_rate.mxd. Just for 2014-2016 three years

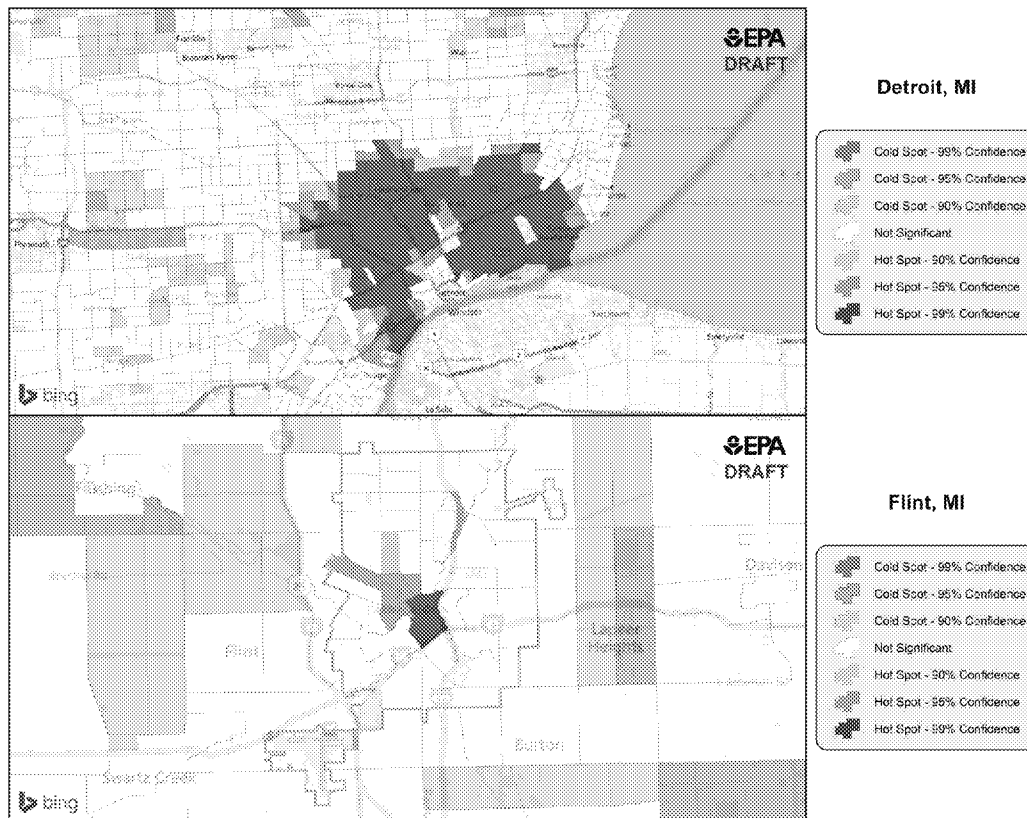
Geospatial Statistical Analysis (Anselin Local Morans I) for MI “Rate of High BLL” (2014-2016)



GIS spatial analysis (method Anselin local Morans)
Cluster
Hot spots for Detroit area and Flint

ED_004465_00011733-00012

Geospatial Statistical Analysis (Getis-Ord Gi*) for Detroit and Flint "Rate of High BLL" (2014-2016)



Hot spots for Detroit and Flint with confidence statistics

GLM model for BLL by key variables

Variable	% of total variance	F-value	P-value
--- weighted by subjects tested ---			
year	20.9	3392	0.000
LOWINCPCT	2.5	10684	0.000
MINORPCT	5.4	1543	0.000
LESSHSPCT	1.7	195	0.000
LINGISOPCT	1.0	352	0.000
UNDER5PCT	0.4	100	0.000
OVER64PCT	0.0	9	0.430
h1950_pct	8.0	1267	0.000
percent	0.0	3	0.093
Total	40.0		
--- weighted by population ---			
year	10.6	1591	0.000
LOWINCPCT	0.4	8045	0.000
MINORPCT	14.7	2918	0.000
LESSHSPCT	3.1	329	0.000
LINGISOPCT	1.0	309	0.000
UNDER5PCT	1.3	251	0.000
OVER64PCT	0.0	1	0.622
h1950_pct	3.5	514	0.000
percent	0.0	5	0.026
Total	34.6		

House ages, Minority, income level education are found to be major contributors by GLM
Need more data to refine model and for local level especially for hot-spot

Ncomputer2: C:\0BLL\MI\tab\z_reg_ct.xls from 4_reg_ct.sas SAS program

Conclusions

- This approach advances science for identifying high Pb risk areas
- “Rate of High BLL” decreasing in MI; slower for higher risk locations
- Consistent findings for high Pb risk areas by Reuters and EPA/ORD, but ORD approach provides better geospatial and temporal resolution
 - different geospatial statistical methods yields similar results
- Many identified high Pb risk areas in MI with higher rates
 - e.g., Detroit area
 - only 3 census tracts in top 100 (all three in 90th to 100th)
- House age, minority, income level, education found to be major contributors using GLM
- Need more data to refine the regression model and for local level, especially for the high Pb risk areas

Next Steps

- Evaluate this geospatial statistical approach with BLL data from other States
- Improve the regression model by identifying additional variables and data in collaboration with EPA Region 5 and local partners, to better predict high BLL locations
- Apply the approach in collaboration with partners to help inform Pb targeting efforts for reducing childhood Pb exposures

Acknowledgements

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